

WORLD FOOD TRENDS AND HOW THEY MAY BE MODIFIED¹

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INTRODUCTION

What can we learn from current world food trends? Are the production trends of the last 30 years likely to continue or are we headed towards the fulfillment of Malthus' predictions? Are we likely to face a future of global food surpluses or a future of increasing food scarcity and widespread hunger? How will expected surpluses and scarcities be distributed across regions, countries, and groups of households and individuals? Are we likely to be faced with increasing inequality, poverty, malnutrition, and human misery or will the future be bright for all? Will future efforts to meet food needs be sustainable or will our natural resources be further degraded?

The answers depend, not on exogenous factors over which we have no control, but on the decisions and actions taken by the major players: households, private and public sector agents, governments, and the international community. If Malthus turns out to be right, it will be because some or all of these players failed to act in an appropriate and timely manner.

The purpose of this paper is twofold: first, to briefly discuss past and expected future trends in food consumption and production;³ and second, to identify actions needed by the international community to facilitate desirable future trends and to modify undesirable trends for the ultimate purpose of assisting developing countries to achieve improved and sustainable household food security in the future.

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³ For a fuller treatment of this matter, the reader is referred to a report by FAO on food and agricultural perspectives to year 2010 to be published shortly.

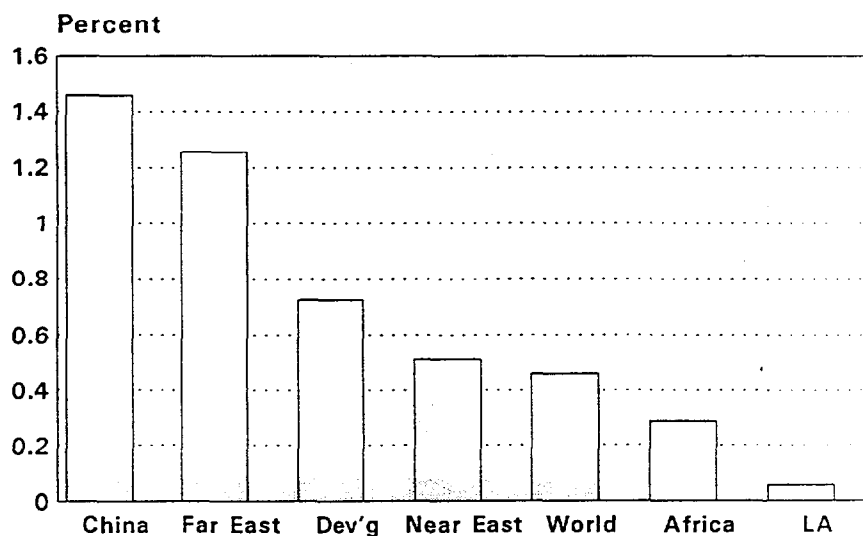
FOOD CONSUMPTION AND NUTRITION TRENDS

Enough food is available in the world today that if it were evenly distributed, nobody should have to go hungry. Availability of daily food energy per capita in the developing countries as a whole increased by 0.7 percent per year during the 1980s (Figure 1). During the 1980s, China and the Far East experienced the greatest increases in per capita food availability, while Latin America and Africa experienced the smallest increase.

Twenty-five developing countries were unable to assure sufficient food energy (2,200 calories per person per day) for their population at the end of the 1980s even if available food energy were evenly distributed within each country (Figure 2). This is down from 45 countries at the end of the 1970s. Even if available food were evenly distributed among residents of each country, about half of the African countries would not be able to guarantee sufficient food to meet the needs of their populations.

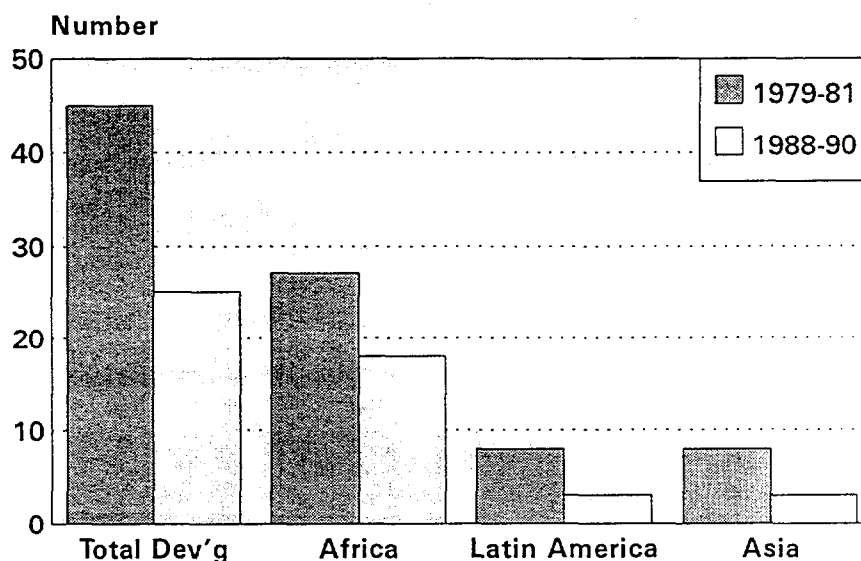
However, available food is neither evenly distributed nor fully consumed. Availability of enough food at global, regional, or national levels does not necessarily mean that everybody is well fed. For people to be food secure—that

Figure 1—Estimated annual change in food availability, 1979-1981 to 1988-1990



Source: FAO, 1990 and 1991.

Figure 2— Number of countries with average food availability below 2200 Kcal/person/day, 1979-81 and 1988-90



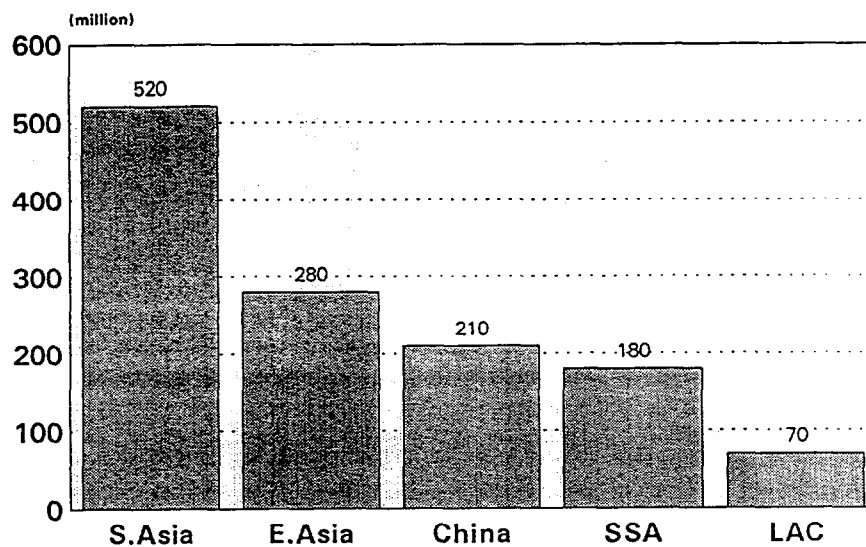
Source: FAO, 1992.

is, to have access at all times to the food required for a healthy and productive life—there must be both availability of food **and** access to food. Access to food by households (and individuals) is conditioned by poverty: the poor usually lack adequate means to secure access to food.

Today, there are over 700 million people who do not have access to sufficient food to meet the needs for a healthy and productive life; they often go hungry and are insecure when they will have their next meal. Many of these hungry adults and children also suffer from diseases of hunger and poverty. For almost one-fifth of the total population of developing countries to be chronically hungry tarnishes the image that the world is now food secure just because it produces enough food.

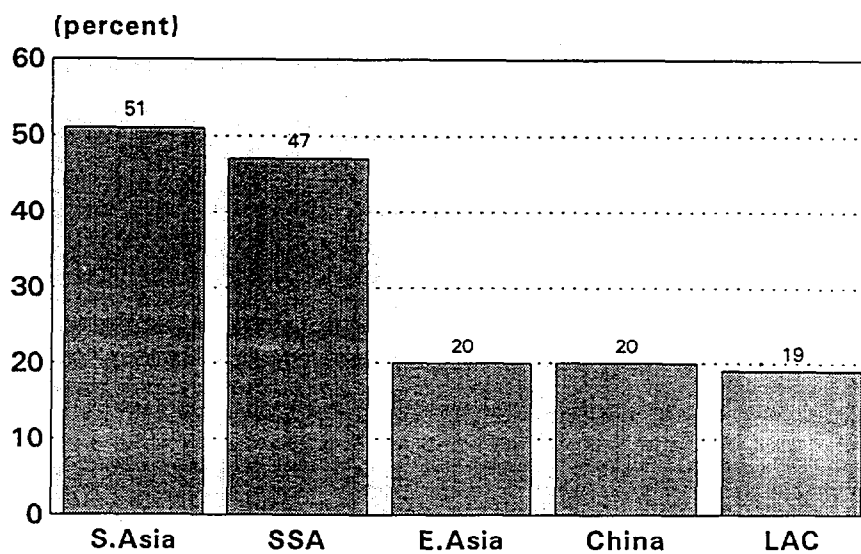
Over one billion people in developing countries were living in poverty in 1985, of whom over 600 million were living in conditions of extreme poverty (World Bank 1990). South Asia is the home of about half of the developing world's poor (Figures 3 and 4). Another 25 percent are found in East Asia, 16 percent in Sub-Saharan Africa, and 7 percent in Latin America and the Caribbean. The prevalence of poverty (the proportion of the population that is poor) is very high in South Asia as well as Sub-Saharan Africa—around 50 percent. World Bank projections (1990) indicate that significant reductions

Figure 3—Poverty in developing countries (number): The poverty line in 1985 PPP dollars is \$370 per capita a year



Source: World Bank, 1990.

Figure 4—Poverty in Developing Countries (percent): The poverty line in 1985 PPP dollars is \$370 per capita a year



Source: World Bank, 1990.

could occur in the magnitude and incidence of poverty if efforts are made to reduce poverty through engaging in efficient labor-intensive growth and providing adequate social services, among other things. The most significant reductions are expected to occur in East Asia and South Asia, but in Sub-Saharan Africa the numbers of the poor are expected to increase by almost 50 percent to 265 million in the year 2000. By the end of the decade, it is projected that one-third of the developing world's poor will be found in Sub-Saharan Africa, compared to about 16 percent currently.

Great progress has been made to meet food needs during the last 30 years. For instance, the number of underfed people⁴ declined from an estimated 976 million in 1974-76 to 786 million in the late 1980s (UN ACC/SCN 1992). But the problem is far from solved. Moreover, keeping up with increasing needs due to population growth, income increases, and dietary changes is itself a formidable challenge.

Hunger and food insecurity have a significant effect on health and nutrition of both adults and children. They can lead to growth failure in children. About 184 million preschool children in developing countries were underweight⁵ in the late 1980s (Table 1 and Figure 5). About half of the underweight children are found in South Asia, and another 16 percent in Sub-Saharan Africa. The prevalence of underweight children is high in South Asia (about 60 percent), but it is also significant in Sub-Saharan Africa and South East Asia (Table 2). It is worrisome that the number of underweight children has risen in recent years, from 164 million in 1980. The increase in the number of underweight children in Sub-Saharan Africa during the 1980s from 19.9 million to 28.2 million is particularly striking (Figure 5). Projections by the UN ACC/SCN suggest that regardless of whether optimistic or pessimistic scenarios are employed,⁶ the number of underweight children in Sub-Saharan Africa will increase during the 1990s (Table 1). The situation in South Asia is also rather precarious, with almost half of the children still projected to be underweight in the year 2000.

In addition to energy deficiencies, micronutrient deficiencies are also widespread in the developing world. About 14 million preschool children (under the age of five years) have eye damage as a result of Vitamin A deficiency (UN

⁴ Population of all ages with energy intake on average below 1.54 BMR over one year.

⁵ Weight less than -2 Standard Deviations of reference.

⁶ The optimistic scenario applies the best observed rate of change over a five-year period during 1975-90 to the regional grouping of countries, whereas the pessimistic scenario applies the worst five-year rate (UN ACC/SCN 1992).

Table 1—Number of underweight preschool children¹ in developing countries, 1980-2000

Region	Number Underweight (millions)				WSC Goals ⁴
	1980	1990	2000		
			Pessimistic Scenario ²	Optimistic Scenario ³	
Sub-Saharan Africa	19.9	28.2	38	30	18
Near East/N. Africa	5.0	4.8	5	3	2
South Asia	89.9	101.2	110	100	59
Southeast Asia	22.8	19.9	17	15	11
China	20.5	23.6	30	24	15
Middle America/ Caribbean	3.1	3.0	4	2	2
South America	3.1	2.8	2	1	1
Global Total	164.0	184.0	206	175	108

Source: UN ACC/SCN, 1992.

¹ Percent below -2 standard deviations from the mean weight-for-age, zero through five years of age.

² The pessimistic scenario applies the worst five-year rate of change over a five-year period during 1975-90 to the regional grouping of countries.

³ The optimistic scenario applies the best five-year rate of change over a five-year period during 1975-90 to the regional grouping of countries.

⁴ Goals for 1990 World Summit for children.

Table 2—Prevalence of underweight preschool children¹ in developing countries, 1980-2000

Region	Percent Underweight				WSC Goals ⁴
	1980	1990	2000		
			Pessimistic Scenario ²	Optimistic Scenario ³	
Sub-Saharan Africa	28.9	29.9	32	27	15
Near East/N. Africa	17.2	13.4	11	8	6
South Asia	63.7	58.5	54	49	29
Southeast Asia	39.1	31.3	24	22	16
China	23.8	21.8	22	16	11
Middle America/ Caribbean	17.7	15.4	16	10	8
South America	9.3	7.7	6	2.5	4
Global Total	37.8	34.3	32	27.5	17

Source: UN ACC/SCN, 1992.

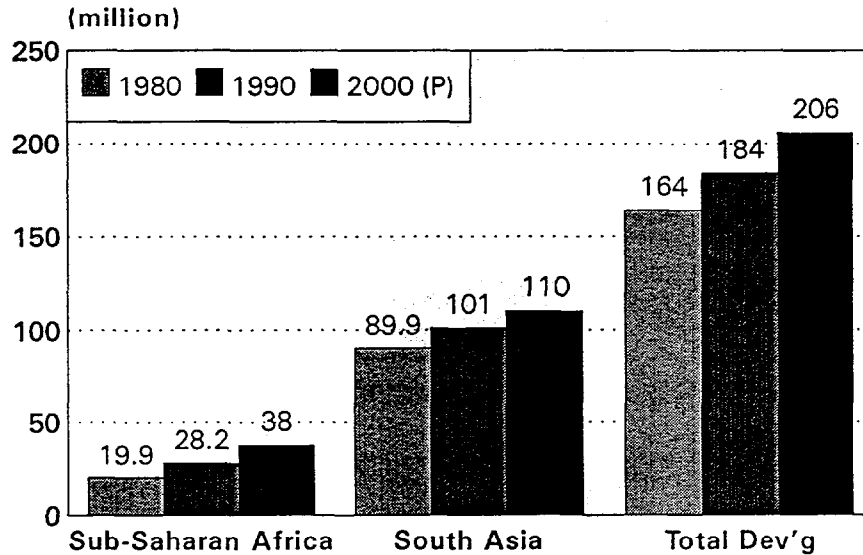
¹ Percent below -2 standard deviations from the mean weight-for-age, zero through five years of age.

² The pessimistic scenario applies the worst five-year rate of change over a five-year period during 1975-90 to the regional grouping of countries.

³ The optimistic scenario applies the best five-year rate of change over a five-year period during 1975-90 to the regional grouping of countries.

⁴ Goals for 1990 World Summit for children.

Figure 5—Malnutrition among preschool children



Source: UN ACC/SCN, 1992.

ACC/SCN 1992). Ten million of these children are found in South East Asia. About 250,000 to 500,000 preschool children go blind each year due to Vitamin A deficiency, and two-thirds of these children die within months of going blind (UN ACC/SCN 1992). Many more children are mildly affected. Recent research has shown that even mild deficiencies can increase mortality significantly. Vitamin A deficiencies are closely linked to diets, which can be influenced by agricultural research and policy.

Iron deficiency affects about one billion people in the world, particularly children and reproductive-aged women (UN ACC/SCN 1992). Iron deficiency leads to anemia, which if not checked can diminish learning capacity and increase morbidity and mortality. In the developing countries, about 370 million women aged between 15 and 49 years of age—42 percent of this population group—were anemic in the 1980s (Table 3, Figure 6). There are tentative indications from South Asia and Sub-Saharan Africa that the prevalence of anemia is rising in nonpregnant adult women of reproductive ages (Figure 7). Anemia partly arises due to diets containing insufficient iron, which again may be addressed by agricultural research and policy. One possible reason why iron deficiency and anemia are going up in South Asia may be the decrease in production of pulses during that same period (Figure 8). Reduction in pulses production is in part a reflection of the larger research input into competing

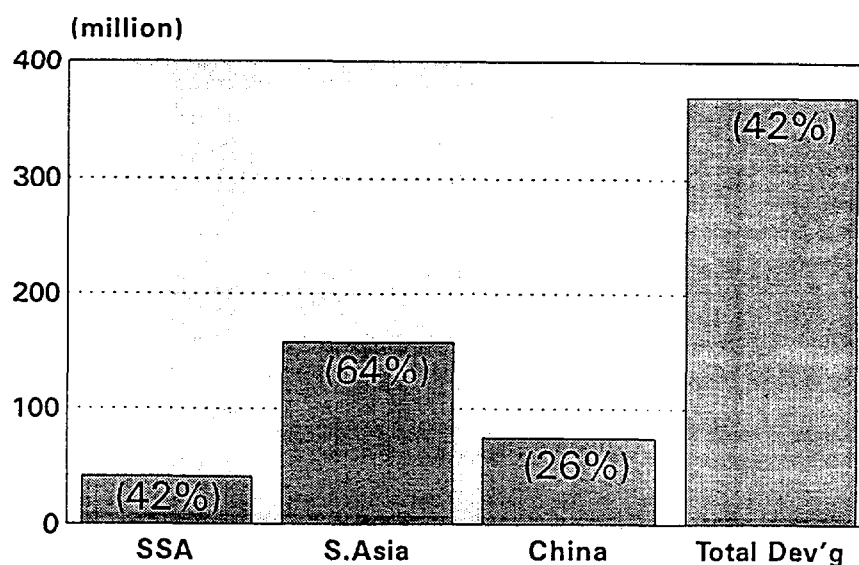
Table 3—Prevalence and numbers of anemic women in developing regions in the 1980s

Region	Percent	Million ¹
Sub-Saharan Africa	42	41
Near East/North Africa	33	15
South Asia	64	158
Southeast Asia	48	57
China	26	75
Middle America/Caribbean	28	9
South America	23	15
Total	42	370

Source: UN ACC/SCN, 1992.

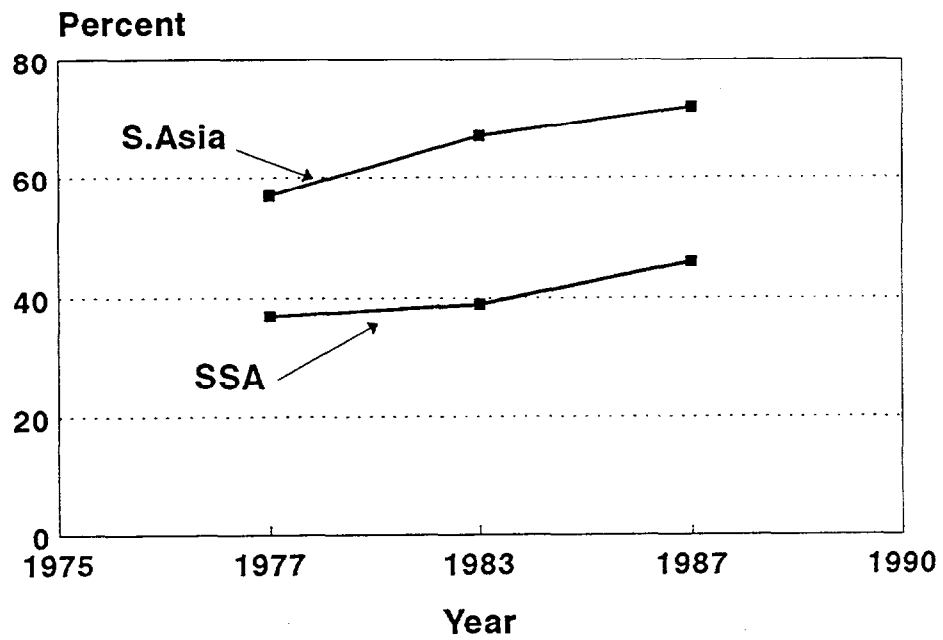
¹ Based on population estimates for 1985.

Figure 6—Prevalence of anemia in women



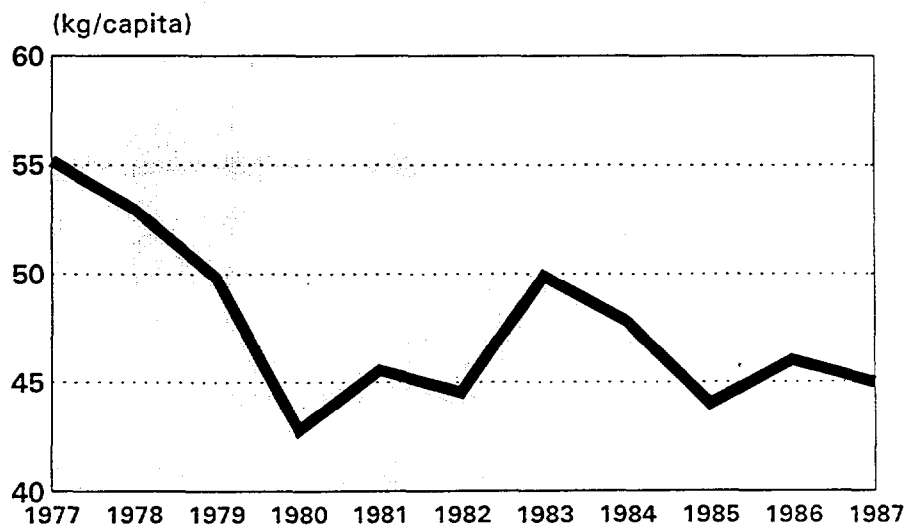
Source: UN ACC/SCN, 1992.

Figure 7—Trends in anemia 1977-1987 nonpregnant women



Source: UN ACC/SCN, 1992.

Figure 8—Trends in per capita production of pulses, South Asia, 1977-1987



Source: FAO, 1992.

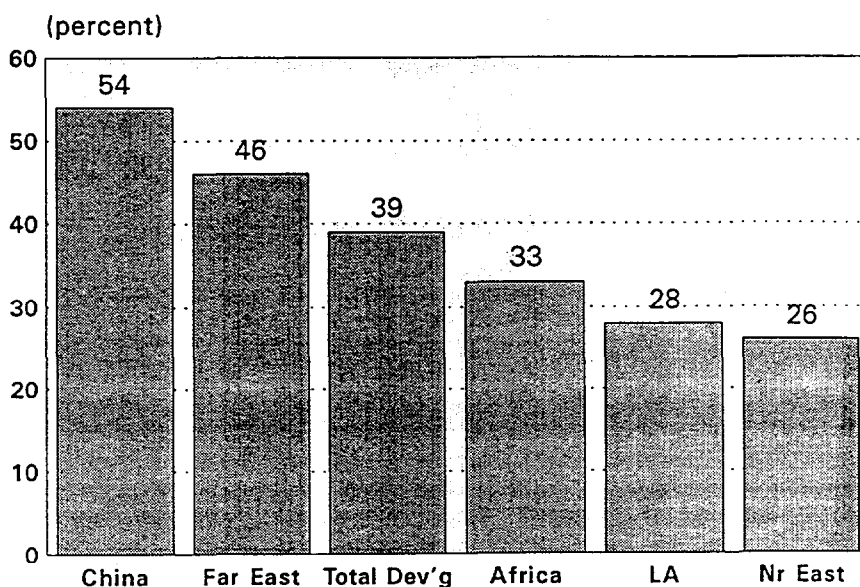
crops such as wheat. This raises important questions regarding research priorities allocated to yield-increasing research for pulses in South Asia.

In summary, South Asia is the home of about half of the developing world's hungry and food insecure people, but this population group is growing rapidly in Sub-Saharan Africa. Much of the poverty and food insecure is concentrated in rural areas, mainly in low-potential areas such as arid zones, but urban poverty is growing rapidly.

FOOD PRODUCTION TRENDS

Food production increased by 39 percent in developing countries as a whole during the 1980s (Figure 9). The food production performance was particularly impressive in China and the Far East. Even in Africa, where concerns regarding the future food situation are greatest, total food production increased by 33 percent during the 1980s. In fact, total food production increased during the 1980s in 101 developing countries, with 30 countries experiencing increases of 40 percent or more.

Figure 9—Change in total food production, 1979-81 to 1989-91

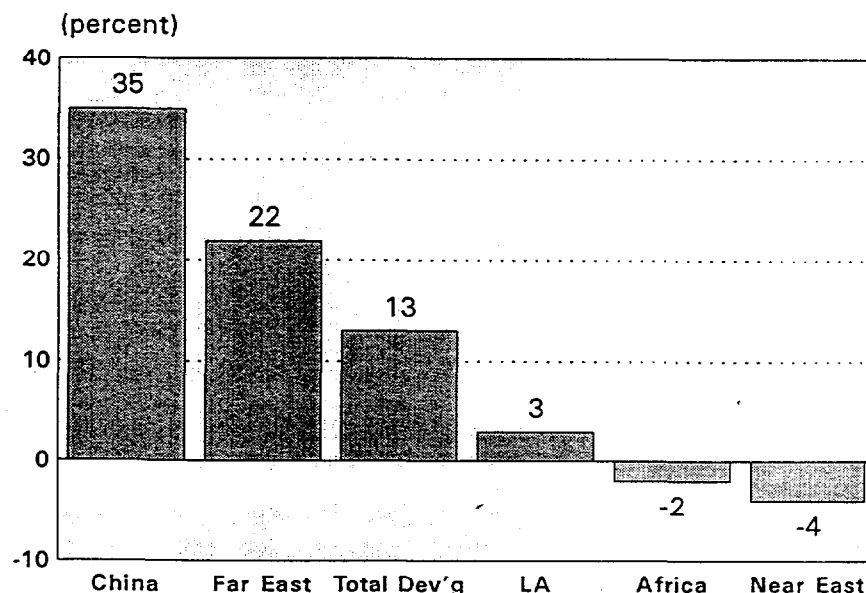


Source: FAO, 1990 and 1991.

However, total food production increases is only part of the picture. In most developing countries, food production increases have barely kept up with population increases. During the 1980s, per capita food production increased by only 13 percent in the developing countries as a group, with the highest increases observed in China and the Far East (Figure 10). In Africa and the Near East, per capita food production declined during the decade. In 75 countries, less food was produced per person at the end of the 1980s than at the beginning. Three-fourths of the African countries fell into that category, as did 64 percent of the Latin American countries and half of the Asian countries. Fifteen countries experienced reductions of 20 percent or more in per capita food production during the decade.

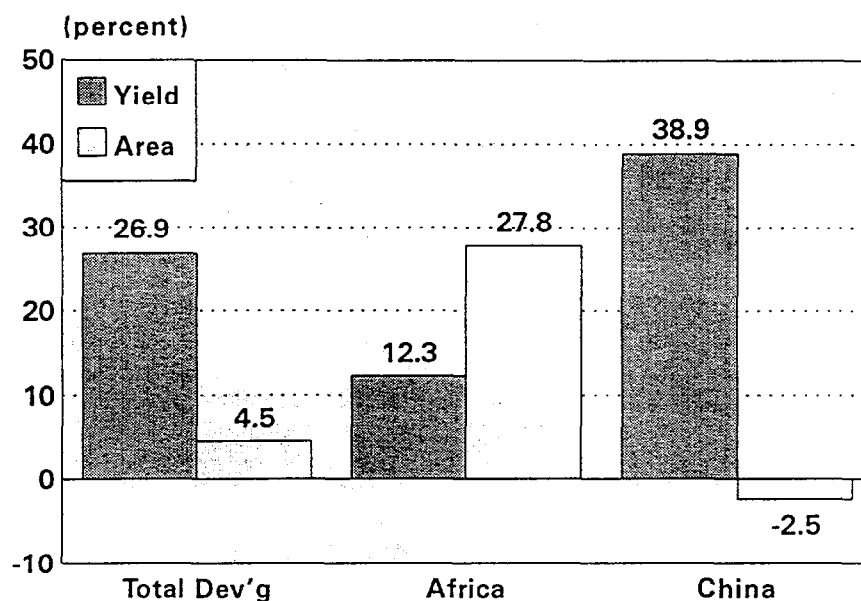
Yield increases were the major source of food production growth in developing regions except Africa (Figure 11). Yield increases contributed about 80 percent of increased cereal production in developing countries as a whole, while area expansion contributed about 20 percent. Yield increases in China were most impressive and were the only source of China's spectacular food production performance during the 1980s, given that area cultivated under cereals actually declined during this decade. Area cultivated under cereals also declined in Latin America. In Africa, by contrast, more than half of cereal

Figure 10—Change in per capita food production, 1979-81 to 1989-91



Source: FAO, 1990 and 1991.

Figure 11—Change in area and yields for cereals, 1979-81 to 1989-91



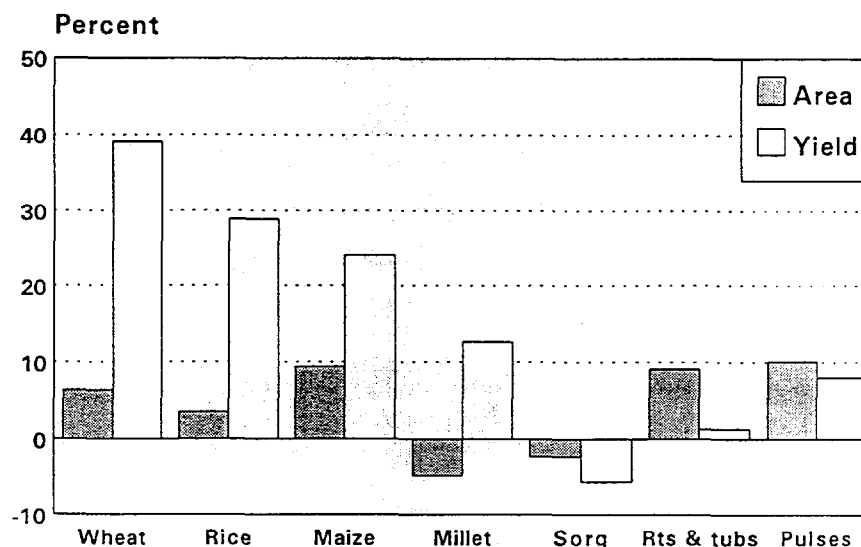
Source: FAO, 1990 and 1991.

production increases during the 1980s came from area expansion. While cultivated area is still increasing in developing countries, it is doing so at a low and declining rate. Area expansion is no longer a feasible option for expanding food production in most of the world, and increased food production in the future will have to come from increased yields.

The most important cereal crops in developing countries are rice, wheat, and maize, which account for 50, 23, and 19 percent of all cereal production respectively. In Africa, coarse grains are particularly important, with maize, sorghum, and millet accounting for 33, 18, and 14 percent of total cereal production respectively. Yield increases have been a particularly important source of production growth in wheat and rice and, to a lesser extent, maize, while they have played a much smaller role for sorghum, roots and tubers, and pulses (Figure 12). Yield-expanding technology is vital for enhancing the food production capacity of developing countries, especially for Africa.

Mainly stimulated by the Green Revolution, yields of maize, rice, and wheat doubled between 1961 and 1991 in developing countries as a group (Figure 13). Yield increases in Asia were notably high, especially for rice and wheat (Figure 14). From 0.5 tons per hectare in 1961, wheat yields in Asia exceeded 3 tons per hectare in 1991. Steady upward movement of the yield

Figure 12—Change in area and yields for selected crops for all developing countries, 1979-81 to 1989-91



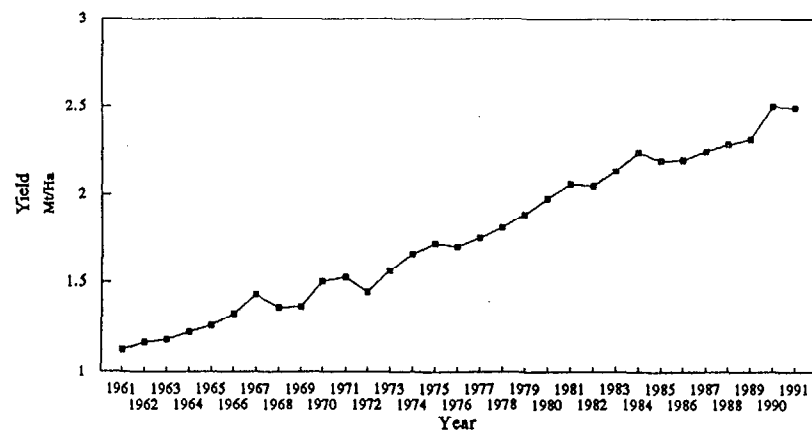
Source: FAO, 1990 and 1991.

trend is clearly observed for the three major cereals. China demonstrates some of the most spectacular yield increases observed in the developing world: maize yields increased from about 1.2 tons per hectare in 1961 to 4.6 tons in 1991; rice yields tripled from 2 to 6 tons per hectare between during this period; and wheat yields increased six-fold from 0.5 to 3 tons per hectare during the same period (Figure 15; Plucknett 1993).

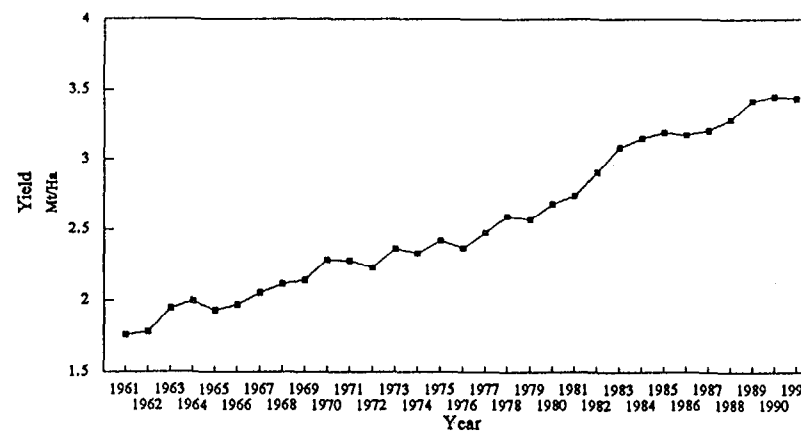
Africa, by contrast, demonstrates poor and variable yield performance with regard to maize, rice, and wheat (Figure 16). While maize yields in Asia rose from 1.2 to 3.4 tons per hectare during 1961-91, maize yields in Africa rose from about 0.8 to 1.2 tons per hectare. Wheat yields rose from about 0.5 tons per hectare in 1961 to about 1.6 tons in 1991. Note that China and Africa had similar yield levels for wheat in 1961 (0.5 tons per hectare), but by 1991 Chinese wheat yields were double those of Africa. That Africa has a long way to go to catch up with Asia is painfully obvious. In the past, African farmers have relied on bringing new land into cultivation in order to expand production. This has, in part, compensated for the slow increases in yields. Continued attempts to expand agricultural land will entail increasing financial and ecological costs. Thus, as has happened in most of Asia, Africa will have to rely on increased yields to meet future food production expansion.

Figure 13—Trend in yields for all developing countries

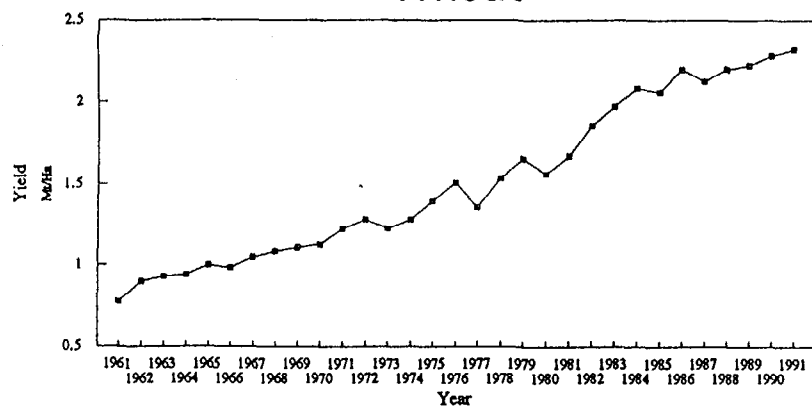
Maize



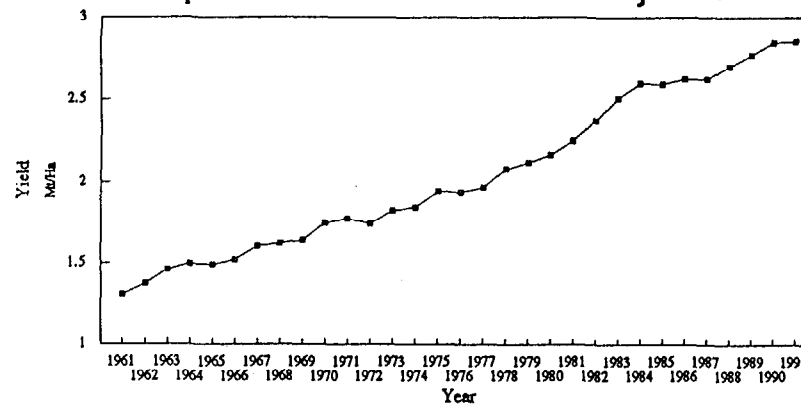
Rice



Wheat



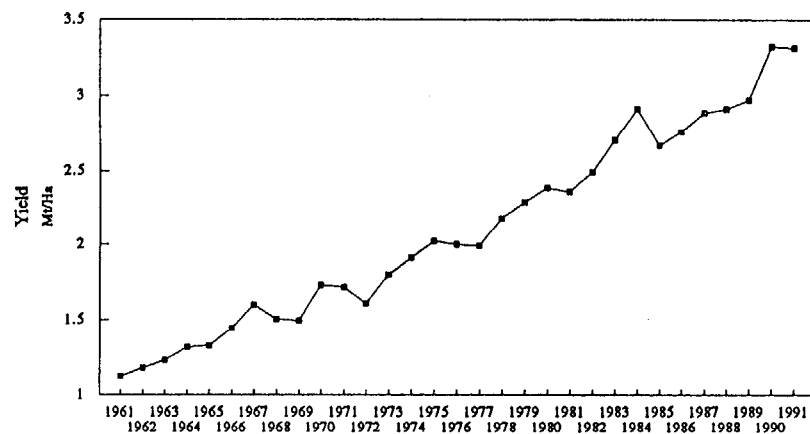
Composite of the three Major Grains



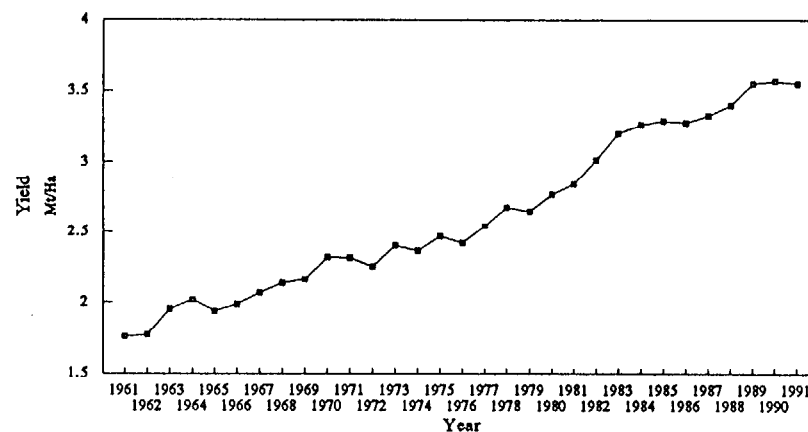
Source: FAO, 1992.

Figure 14—Trend in yields for Asia

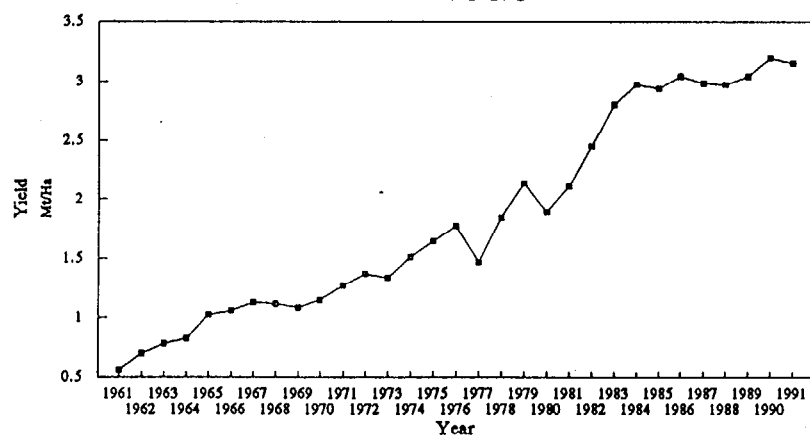
Maize



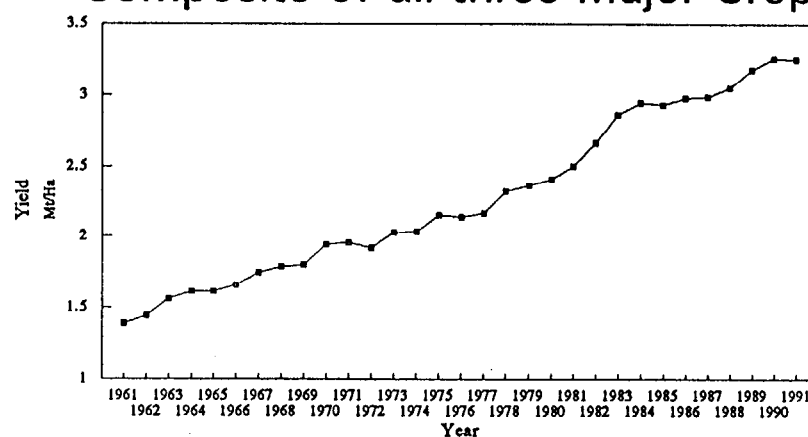
Rice



Wheat



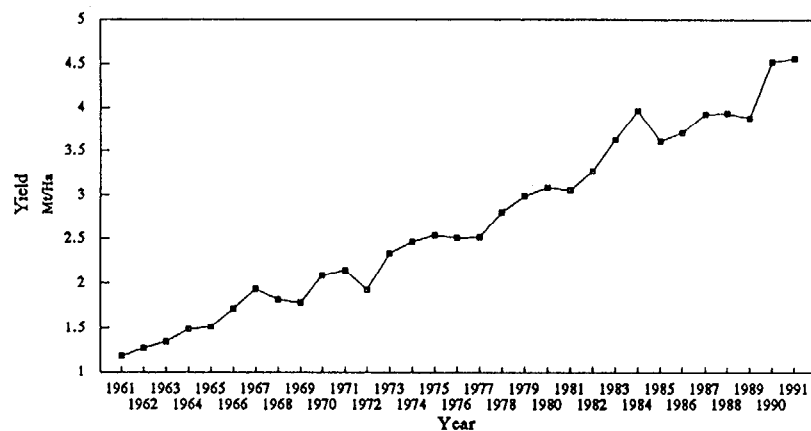
Composite of all three Major Crops



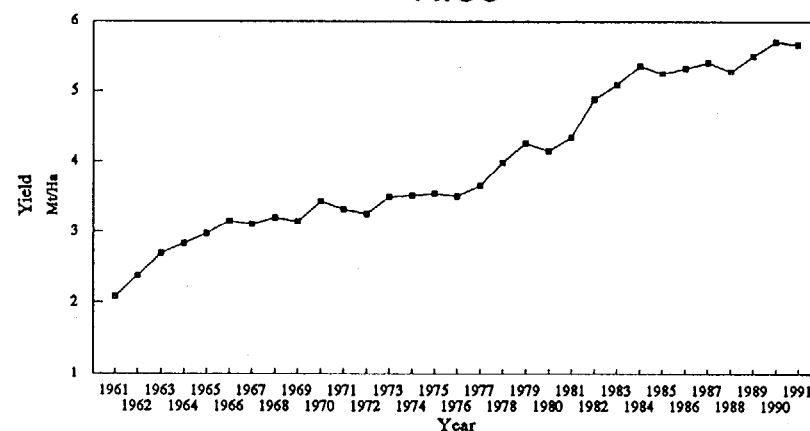
Source: FAO, 1992.

Figure 15--Trends in yields for China

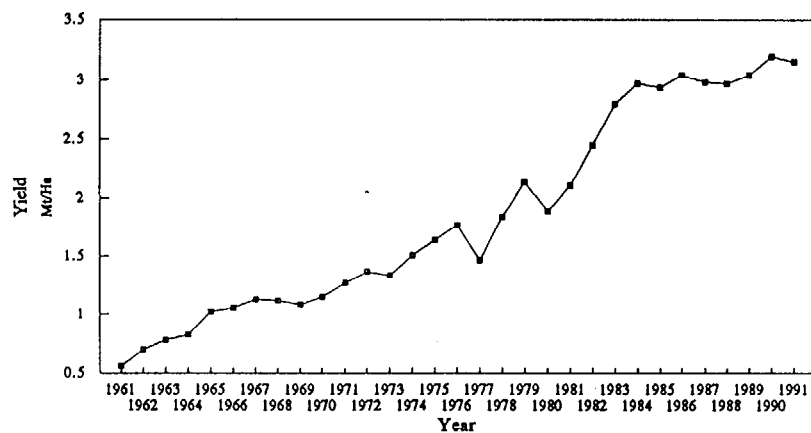
Maize



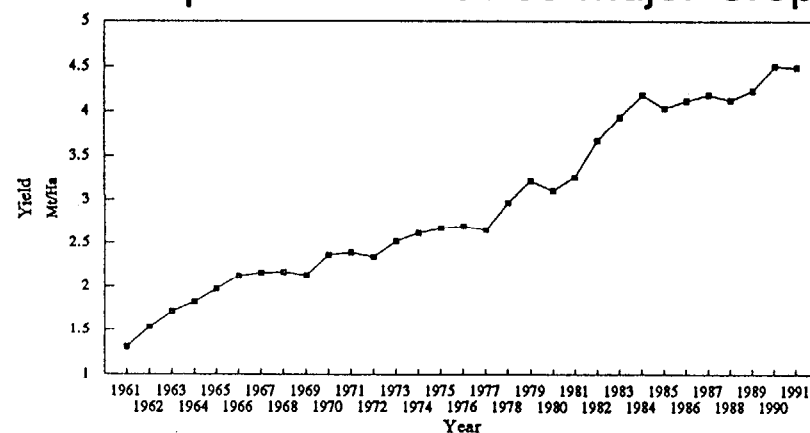
Rice



Wheat

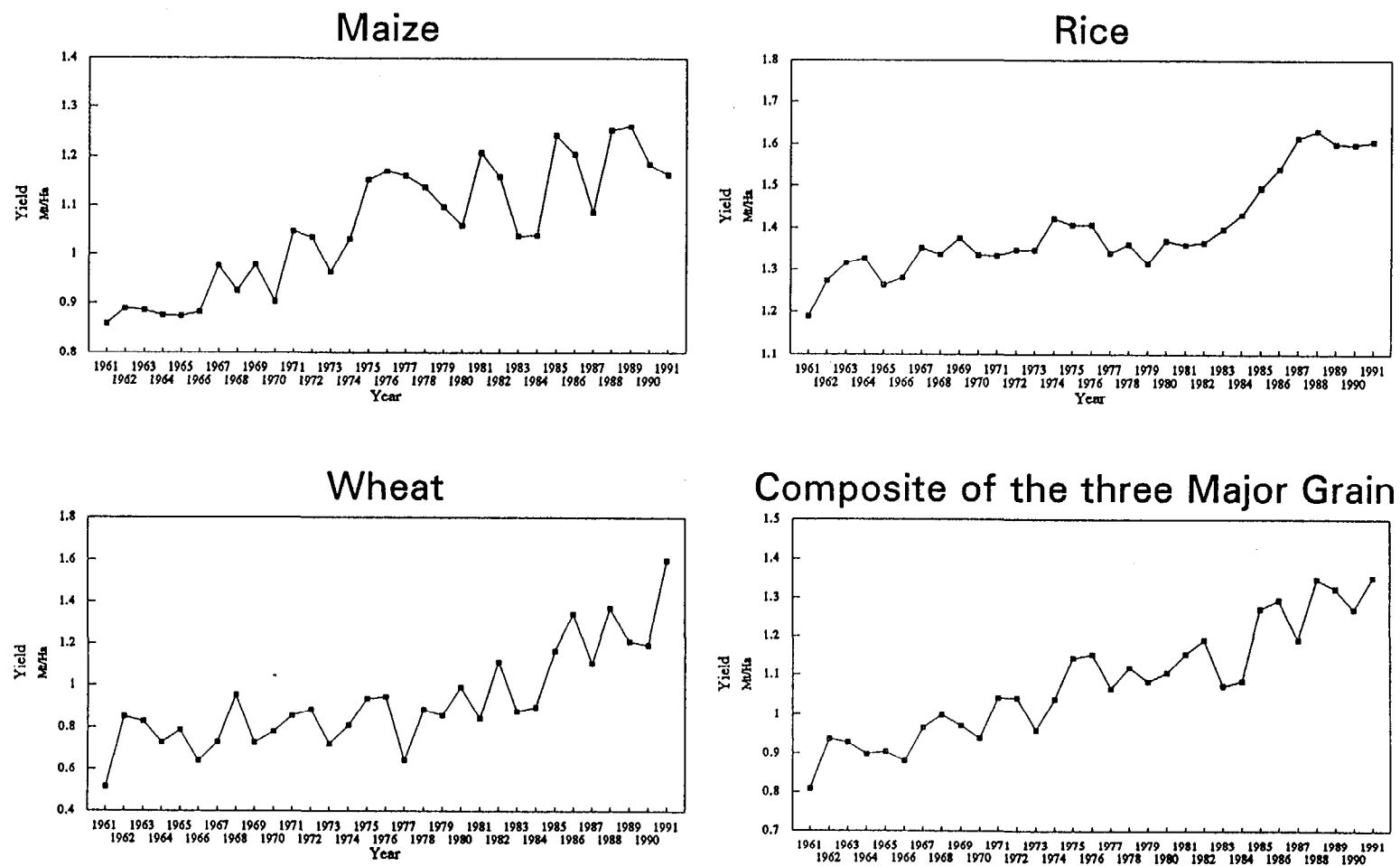


Composite of all three Major Crops



Source: FAO, 1992.

Figure 16—Trend in yields for Africa



Source: FAO, 1992.

In Asia, some troubling signs are evident regarding the yields of the two major crops of wheat and rice. The annual rate of yield increases is slowing. Rice yields increased rapidly during the 1960s and 1970s, but since then the annual rate of yield increase has slowed and the growth rate is now almost back at the rate prevailing in the early 1960s. Between the mid-1970s and early 1980s, rice yields increased at an annual rate of about 3 percent, but then slowed to less than 2 percent during the remainder of the 1980s (Table 4). In South East Asia, rice yields have declined by half from an annual rate of 3.2 percent in the 1970s to 1.6 percent in recent years. Even in China, rice yield growth rates have slowed from more than 4 percent per year in the late 1970s to about 1.6 percent during the 1980s. Only in India have rice yield growth rates increased in recent years. The situation is similar with regard to wheat. Yield growth rates have slowed down in Asia as a whole from 4.4 percent in the late 1970s to 2.7 percent in the 1980s (Table 5). This trend is observed across Asia, with the exception of South East Asia, where yield growth rates increased from -0.8 percent in the late 1970s to 2.8 percent in the 1980s.

In addition to lower rates of increase in yields, the increasing variability in total world grain production should be of serious concern (Figure 17). Part of the explanation for the increasing variability in cereal production is the increased similarity of cereal varieties across areas.

Table 4—Growth in Asian rice yields (percent per annum)

	1957-59 to 1965-67	1965-67 to 1973-75	1973-75 to 1981-83	1981-83 to 1988-90
Total Asia	1.7	2.3	2.9	1.9
Southeast Asia	1.5	2.9	3.2	1.6
South Asia	1.9	1.0	1.7	2.0
China	3.2	1.7	4.1	1.6
India	0.7	2.2	1.6	3.2

Source: IRRI data analyzed in Rosegrant and Svendsen, 1993.

Table 5—Growth in Asian wheat yields (percent per annum)

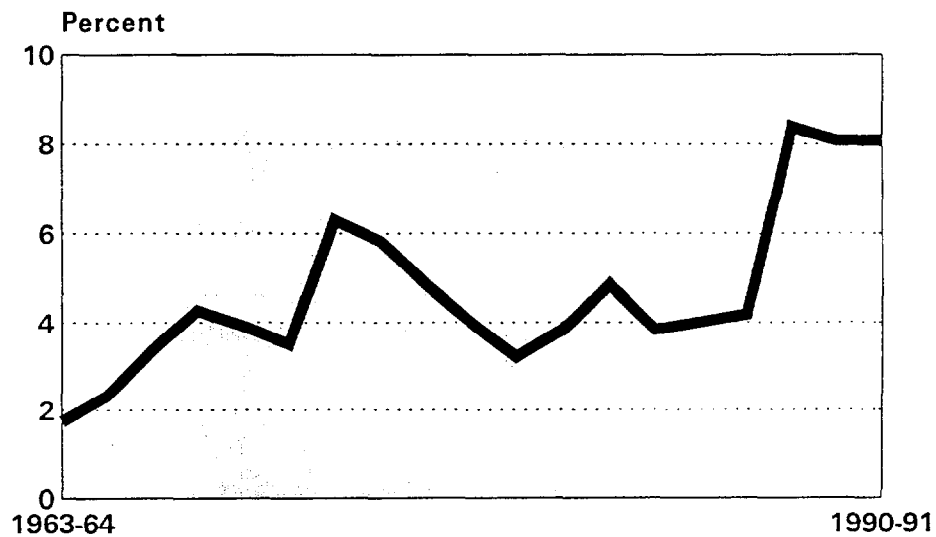
	1961-63 to 1965-67	1965-67 to 1973-75	1973-75 to 1981-83	1981-83 to 1988-90
Total Asia	6.2	4.1	4.4	2.7
Southeast Asia	0.4	4.6	-0.8	2.8
South Asia	-0.4	5.0	3.2	1.1
China	11.5	4.3	5.7	2.9
India	1.0	4.9	3.5	2.9

Source: FAO data analyzed in Rosegrant and Svendsen, 1993.

World grain production per person increased steadily during the 1950s, 1960s, and 1970s, but recent trends suggest that there has been stagnation during the 1980s and early 1990s (Figure 18). Some are arguing that world grain production per person is now declining (Brown, Kane, and Ayres 1993). In order to get a better view of the trend in the 1980s, we have amplified that part of the figure (Figure 19). Based on statistical tests, the trend between 1980 and 1993 is best represented by a horizontal line. Thus, it appears that the world grain production per person has been constant rather than declining during the 1980s and early 1990s. The production data for the last two years are preliminary, but if they turn out to be correct and if the grain production performance continues to fall below that of the early 1990s, then we will soon be on a statistically significant downward trend of grain production per person.

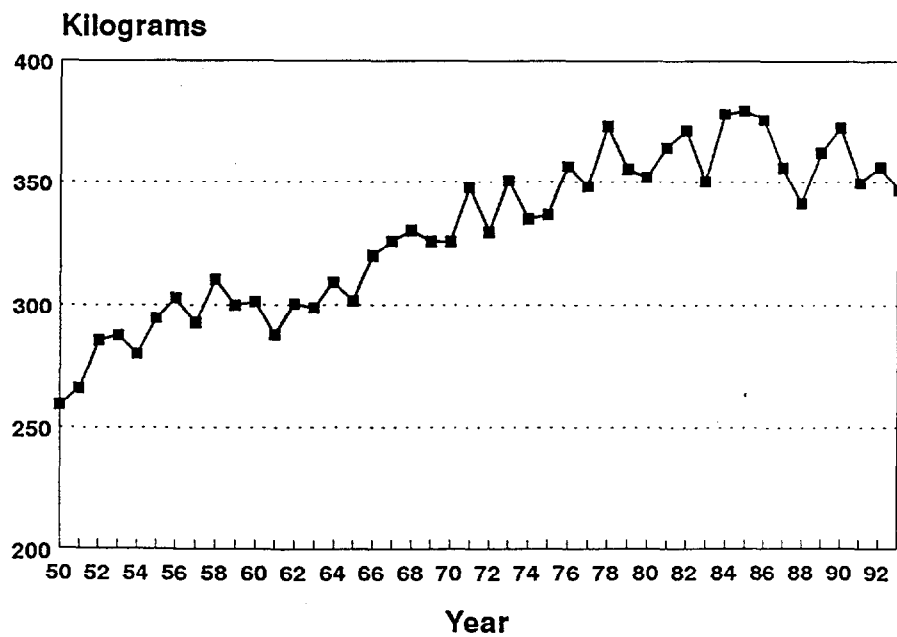
The recent stagnation in world grain production per person should be of serious concern because factors other than population growth will continue to push grain demand upward. It is particularly noteworthy that the demand for feed grain increases rapidly with increasing incomes beyond a certain income level, as illustrated by Brazil and Indonesia (Figures 20 and 21). While projected growth in cereal consumption for food is very close to population growth (Figure 22), expected growth in feed grain demand is more than twice the expected population growth. Once incomes have increased beyond a

Figure 17—Estimated probability of a five-percent shortfall below trends in world grain production



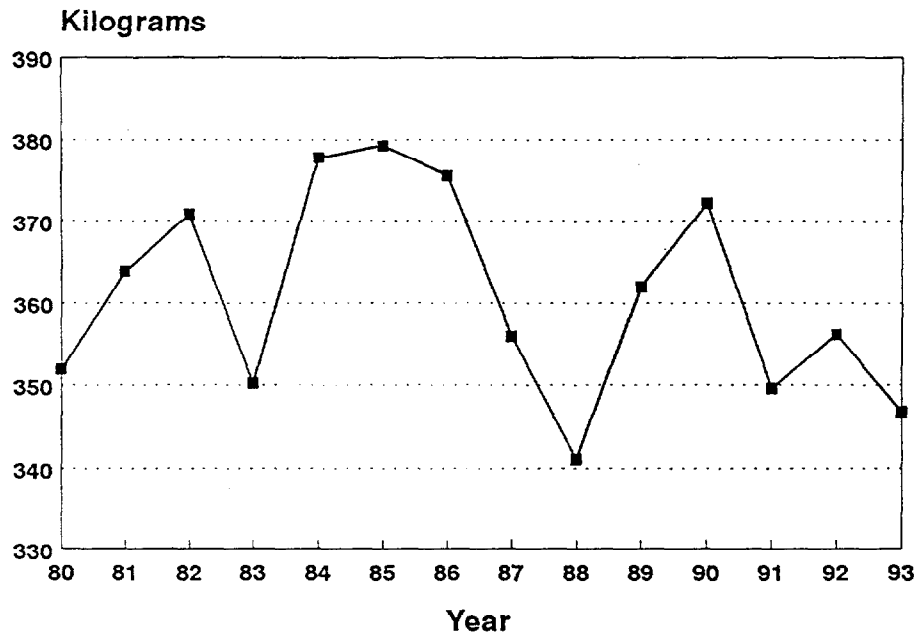
Source: Hazell, 1993.

Figure 18—World grain production per person, 1950-93



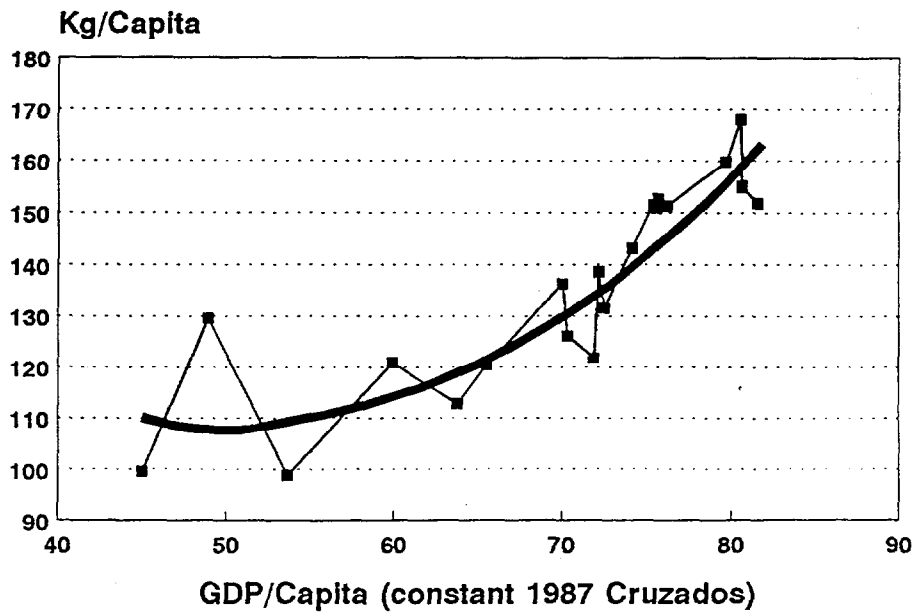
Source: FAO, 1992.

Figure 19—World grain production per person, 1980-1993



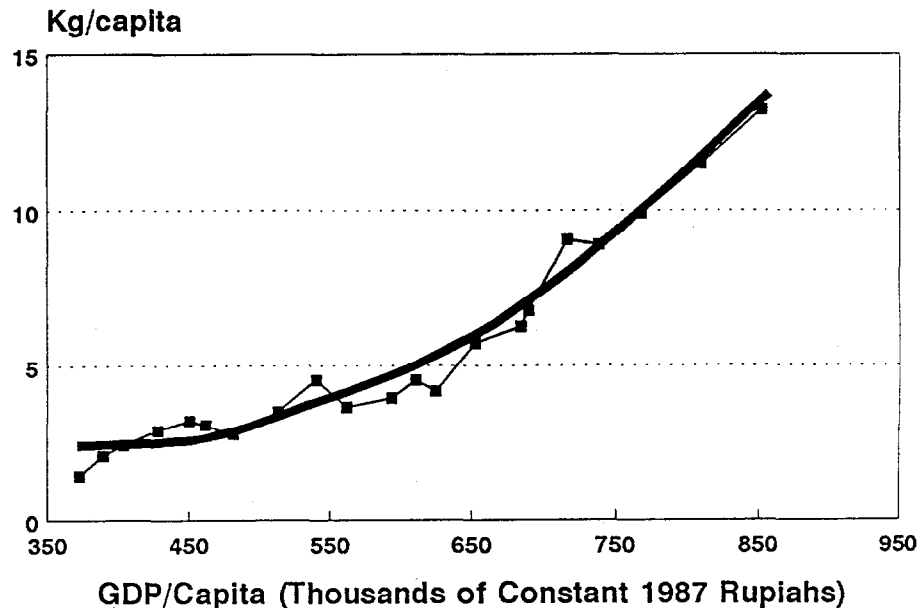
Source: FAO, 1992.

Figure 20—Per capita feedgrain use as function of GDP per capita, Brazil, 1970-1990



Source: USDA, 1993; World Bank, 1992b.

Figure 21—Per capita feedgrain use as function of GDP per capita, Indonesia, 1970-1990



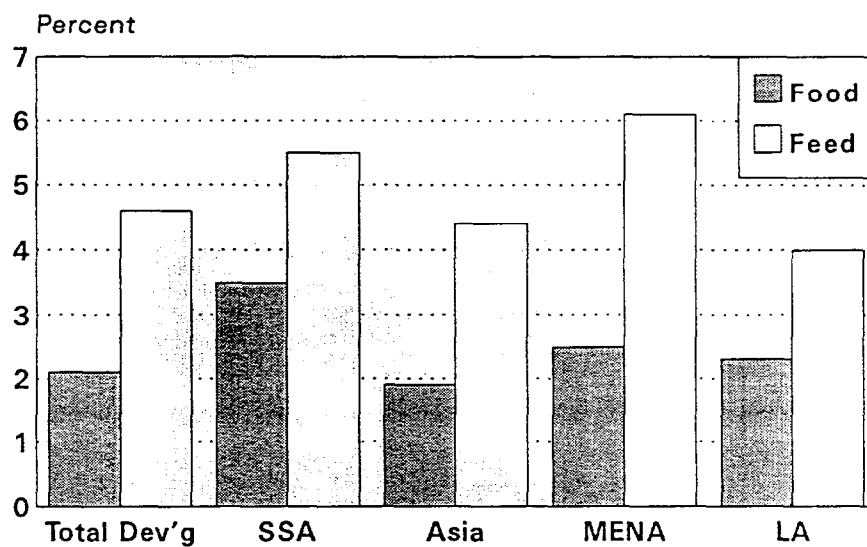
Source: USDA, 1993; World Bank, 1992b.

certain point, feed grain demand levels off, as demonstrated by Korea (Figure 23). Most developing countries have incomes that are still below the level where the feed grain use increases rapidly or they are in the phase of the steep increase in feed grain use.

Non-cereal staples such as roots, tubers, and plantains are of great importance in many regions both in terms of their contribution to total food availability and in terms of their importance in the diets and incomes of the poor. According to FAO, non-cereals supply 40 percent of total food energy for the half of the Sub-Saharan African population with the highest risk of food insecurity. Non-cereal staples, notably potatoes and cassava, play a very significant role in the diets of the poor also outside Africa, and efforts to accelerate yields of those crops in a sustainable manner should be an integral part of efforts to reduce food insecurity.

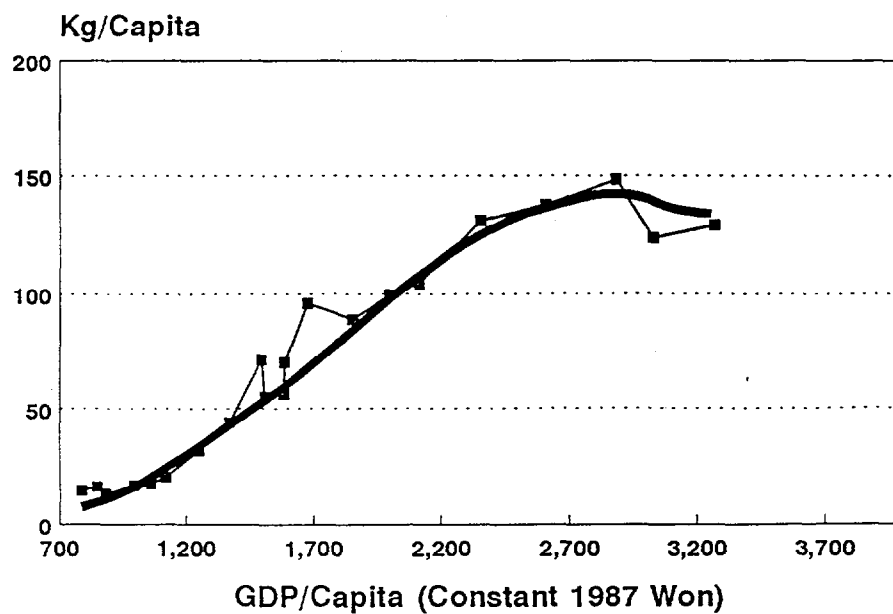
Food prices are on a long-term downward trend (Figure 24). For the past four to five decades—except for a few short periods such as the food crisis of the early 1970s—global food supplies have been sufficient to assure that international food prices have decreased. Where are food prices headed now?

Figure 22—Projected annual growth in cereal consumption for food and feed, 1980-2000



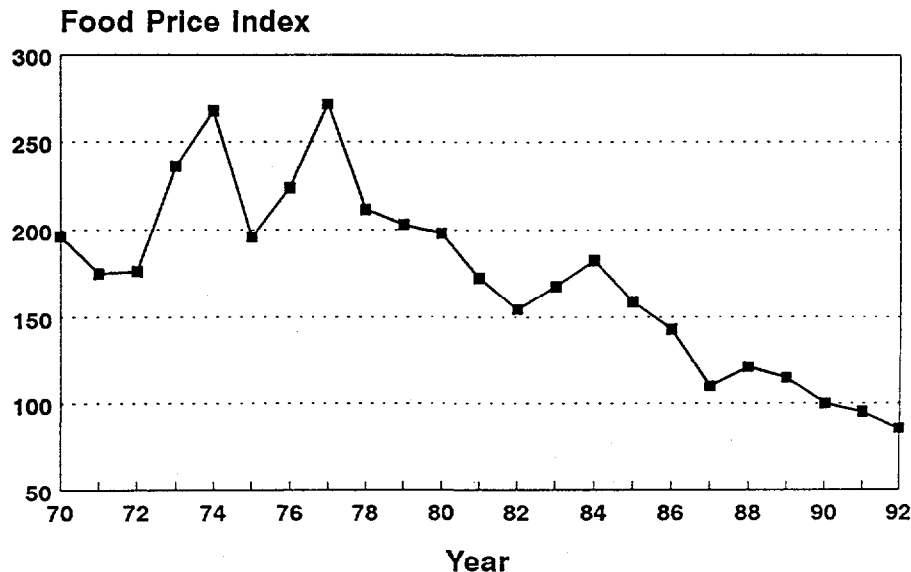
Source: Paulino, 1986.

Figure 23—Per capita feedgrain use as function of GDP per capita, Korea, 1970-1990



Source: USDA, 1993; World Bank, 1992b.

Figure 24—World food price index, 1970-92 (in constant dollars, 1990 = 100)



Source: World Bank, 1993.

Most recent projections conclude that it is unlikely that real food prices in the international market will increase significantly during the rest of the 1990s.

Much depends on the outcome of the current trade negotiations, particularly the Uruguay round of the General Agreements on Tariffs and Trade (GATT), and on developments in China, India, Eastern Europe, and the former Soviet Union. If the GATT negotiations are successful in significantly reducing agricultural subsidies and trade distortions in the European Economic Communities (EEC), the United States, and Japan, we can expect food price increases in the world market. These price increases will vary among commodities and will depend on the magnitude and speed of market liberalization. However, these are at least three reasons why such price increases will be very limited or will not occur at all. First, it now appears that any reductions in agricultural trade distortions in the EEC, the United States, and Japan are likely to be small and spread out over a long period of time. Second, there are strong indications that the negotiations will result in enhanced supply management rather than freer markets in these countries, which will keep domestic production at higher levels than justified by free markets. Third, it is likely that Eastern Europe and the former Soviet Union will increase agricultural production considerably faster than demand during the next 10 years. Further reductions in livestock production and consumption in those

countries may release significant amounts of feedgrain to the world market. This, in turn, is likely to depress international prices. Furthermore, as the effects of structural adjustment take hold, the agricultural sector of these countries are likely to become much more productive.

China and India produce about one-third of the world's cereals and more than half of the cereal production of the developing countries. The cereal production of these two countries is about 2.5 times the amount traded internationally and about twice the current year-end world cereal stock. Thus, changes in cereal production or demand in these countries could have major effects on international prices and stocks.

Decreasing real world market prices for food are an outcome of both the production performance and food demand. Food needs are represented in the world market only if they are matched by purchasing power. Thus, future food prices will be influenced by the extent to which the one billion people who currently earn one dollar a day or less as well as the 90-100 million people added every year will be able to convert their food needs into effective market demand. Low and decreasing real food prices in the world market are not incompatible with high and increasing poverty, food insecurity, hunger, and malnutrition. In fact, the former may be a result of the latter.

FACTORS INFLUENCING FUTURE FOOD PRODUCTION AND CONSUMPTION

Global and regional food production and consumption during the next 10 to 20 years will be influenced by a large number of factors. Changes in the following four sets of factors are likely to be particularly important:

1. Economic growth and economic policies,
2. Population growth and urbanization,
3. Rural infrastructure, agricultural production technology, and access to modern inputs, and
4. Natural resource management and environmental considerations,

Each factor is discussed below, with an emphasis on its expected impact on future food production and consumption.

Economic Growth and Economic Policies

As shown in Table 6 and Figure 25, growth in real per capita income during the 1980s was disappointing for developing countries as a whole.

However, the low average rate of growth covers large variations among regions. The high rates of economic growth in Asia are expected to continue through the 1990s, while incomes in Sub-Saharan Africa are expected to keep pace with population growth.

Future economic growth depends on internal policies as well as on the international environment. The extent to which current structural adjustment and economic reforms in Latin America, Sub-Saharan Africa, the Commonwealth of Independent States (CIS), Eastern Europe, and selected countries in Asia and the Middle East are carried to a successful completion at the appropriate speed and sequence is of paramount importance for future economic growth in those countries.

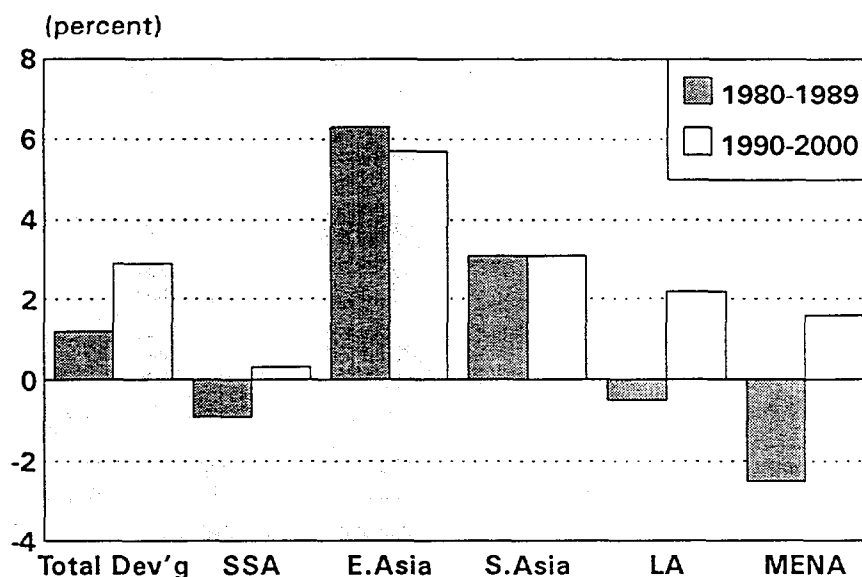
Closely related to this issue is the question of the most appropriate role of the state in a market-oriented economy with inappropriate institutions, poor infrastructure, and insufficient experience by the private sector in dealing effectively in a competitive market environment. Overreaction to past failures of excessive and inappropriate state intervention may cause governments to take on a passive role where intervention is needed to assure that the markets function effectively and to deal with externalities in the economy.

Table 6—Annual growth in real per capita income, 1980-2000 (percent)

Region	1980-89	1990-2000
Sub-Saharan Africa	-0.9	0.3
East Asia	6.3	5.7
South Asia	3.1	3.1
Latin America	-0.5	2.2
Middle East/N. Africa	-2.5	1.6
Developing countries	1.2	2.9

Source: World Bank, 1992a.

Figure 25—Annual growth in real per capita income



Source: World Bank, 1992b.

Future economic growth will also depend on the international trade environment, including trade distortions by developed countries, and access to external aid. Import restrictions for agricultural and non-agricultural products in Japan, the European Common Market, and the United States, along with domestic agricultural subsidies and implicit and explicit export subsidies for agricultural products are of particular concern. The World Bank (1992a) estimates that a 50 percent reduction of the current trade protection by Japan, the European Common Market, and the United States would result in an increase of US\$50 billion in export revenues to developing countries, which is roughly equivalent to the total official economic aid from OECD countries to developing countries (World Bank 1993). The largest share of this economic gain (54 percent) would be captured by the Far East (World Bank 1992a).

Trade liberalization is an integral part of structural adjustment and economic reforms in most developing countries. It is particularly noteworthy that historical trends of protection are being replaced by a large degree of trade liberalization in many Latin American countries with expected positive effects on economic growth. However, the sustainability of Latin America's trade liberalization policies is in danger, because they are not being matched by trade liberalization in the United States, Europe, and Japan. Failure to achieve sizable reductions in agricultural protection in OECD countries and failure to

ratify the NAFTA agreement on the part of the United States would make it extremely difficult for Latin America to continue its elimination of nontariff barriers and large reductions of tariffs. The result will be reduced economic growth and increasing unemployment and poverty in the region.

During the 1980s, government policies in most developing countries were dominated by the need to deal with economic crises, including balance of payment problems. During the first half of the decade many countries attempted to correct balance of payment problems in an unrealistically short period of time. Demand-contracting stabilization policies caused severe hardships on both the poor and the middle class. Hopefully such stabilization policies are a thing of the past. More recently, emphasis has been on supply-enhancing structural adjustments and policy reforms. Unfortunately, insufficient attention has been paid to adjustments and reforms that improve the productivity of the human resource (health, education, and nutrition) and enhance access by the poor to productive resources such as land and capital. Furthermore, while policy reforms frequently aim at market liberalization and privatization and reductions of inefficiencies and rents captured by the public sector, much more attention should be given to the removal of distortions in input and output markets, asset ownership, and a series of other institutional and market distortions that are adverse to the poor. Without such attention, existing institutions will continue to be adverse to the poor, and market liberalization and privatization are likely to result in rapid accumulations of wealth among a small number of people with only limited benefits to the poor.

Improved human resources and enhanced access by the poor to other productive resources will contribute to reduced poverty and food insecurity as well as to higher economic growth. Policies that will expand investment in rural infrastructure, primary health care, education, agricultural research and improved production technology, technical assistance, and credit are urgently needed to enhance income earnings, food security, and nutritional status among the rural poor and to reduce unit costs of food production for the benefit of both rural and urban poor.

Policies are needed to pursue the triple goal of poverty alleviation, increased productivity in food production, and sustainability. No attempts will be made to detail such policies here but such a list would include policies to improve water management, expand agricultural research, and deal effectively with externalities resulting in land degradation and deforestation. In addition, policies are needed to protect the rural and urban poor from both chronic and transitory food insecurity in the short run. Such policies would include targeted food and cash transfers of various types, labor-intensive public works programs, and emergency relief. International food aid may play an important role.

In the poorest of the developing countries, including virtually all of Sub-Saharan Africa, effective population policies focused on family planning and reduced rural-urban migration are urgently needed. However, such policies will be fully successful only if accompanied by alleviation of poverty and improvements in education, primary health care, and nutrition. While investment in urban infrastructure, including social infrastructure, must be accelerated to accommodate the rapid urban population growth and avoid further expansions in urban slums and associated misery, rural development, including enhanced income-earning opportunities for the poor and access to primary health care, is critical to reduce migration of poor rural residents to urban areas. Provision of education in rural areas may accelerate migration but the migrants are less likely to end up in slums.

In low-income developing countries, the agricultural sector is the most effective, and frequently the only viable, lead sector for overall economic growth. Agricultural growth stimulates economic growth in nonagricultural sectors, which in turn results in increased employment and reduced poverty. Unfortunately, international financial support to agricultural development has decreased very significantly during the 1980s and early 1990s. A recent study shows that real external assistance to agriculture in low-income countries declined from \$12 billion in 1980 to \$10 billion in 1990, while the share of agriculture in development assistance declined from 20 percent in 1980 to 14 percent in 1990 (von Braun et al. 1993). At the same time, no real advances have been made to reduce the negative effects on developing-country agriculture from the protection of OECD agriculture. A reversal of the downward trend in international support for developing-country agriculture is urgently needed not only to assure future food supplies and protect natural resources, but also to facilitate general economic growth in low-income developing countries. This is also critical for expanding export markets for both agricultural and nonagricultural commodities from OECD countries. Preliminary findings from on-going IFPRI research indicate that agricultural growth in low-income developing countries results in growth in agricultural imports that—in percentage terms—exceeds the growth in the agricultural sector. Thus, rather than reducing export markets as feared by some farm groups in OECD countries, foreign assistance to developing-country agriculture expands these markets.

Although an economically healthy agricultural sector is usually a necessary condition for the alleviation of rural poverty, it is not sufficient. In most developing countries, the rural poor derive a large share of their income from sources other than agriculture, although some of these income sources depend on agriculture directly or indirectly. Furthermore, many of the rural poor are net buyers of food. Thus, while policies to stimulate expanded agricultural production will be beneficial to some of the rural poor, others will be either

unaffected or negatively affected. Policies that increase food prices for the net-food buying rural poor are an example of the latter.

The emphasis should be on low-cost rather than high-cost agriculture. Technological change and improved rural infrastructure are among the most effective ways to facilitate production expansions at reduced unit-costs. As illustrated by the case of wheat in Saudi Arabia (Figure 26), large production expansions can be obtained even under very adverse conditions if costs are of little concern. As a result of high prices and heavy investments, Saudi Arabia increased wheat production from virtually nothing prior to 1980 to more than four million tons by 1992. Net imports of more than half a million tons in 1982 were converted to net exports of almost two million tons in 1991.

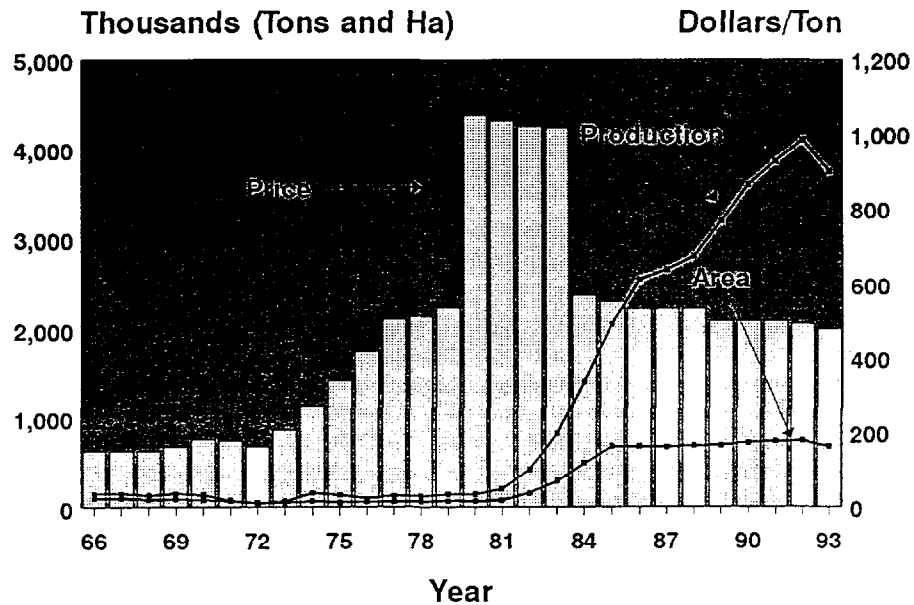
Population Growth and Urbanization

According to the United Nations, the current world population of 5.5 billion will increase to approximately 10 billion by 2050. Although the annual growth rate is falling for the world as a whole, the annual population increase during the next 20 to 30 years, of slightly less than 100 million people, will be the largest ever. Approximately 97 percent of this increase is projected to occur in the Third World, with Africa alone accounting for 34 percent of the growth. Thus, although the demographic transition has resulted in reductions in annual population growth rates in Asia and Latin America, the reductions are insufficient to counter the absolute increases (Figure 27).

The rate of growth is particularly strong in urban areas (Figure 28) and it is projected that approximately 44 percent of the population of developing countries will reside in urban areas by 2000, up from 22 percent in 1960 and 31 percent in 1980 (Figure 29).

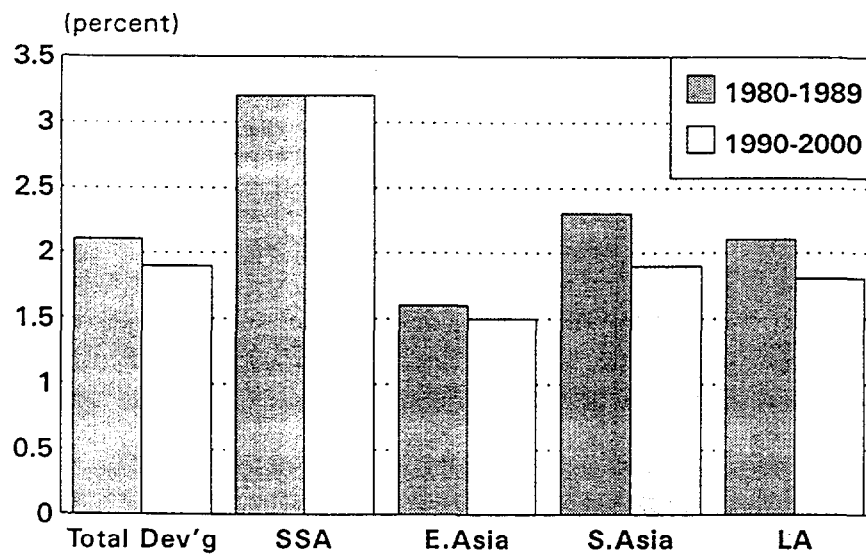
Population growth of the magnitudes mentioned above will severely constrain efforts by the Third World to improve per capita income and well-being, while greatly increasing the need for food and other basic necessities. It is unlikely that Sub-Saharan Africa will be able to cope with the large population growth without significant increases in poverty and decreases in the overall standard of living. Past and current famines in the region, while blamed on droughts, wars, and adverse agricultural policies, are to a significant extent an outcome of past high rates of population growth and widespread poverty. Failure to significantly reduce population growth rates in the region within the next 20 years will render all other development efforts insufficient to avoid future famines, poverty, and human misery of a much greater magnitude than seen in the region so far.

Figure 26—Wheat production, area, and prices in Saudi Arabia, 1966-93



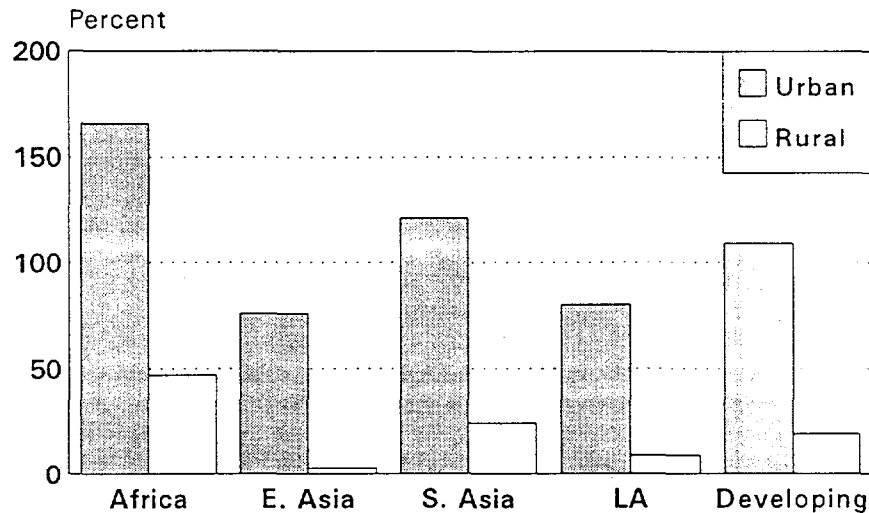
Source: USDA, 1993.

Figure 27—Annual population growth, 1980-2000



Source: World Bank, 1992b.

Figure 28—Projected increase in urban and rural populations, 1980-2000

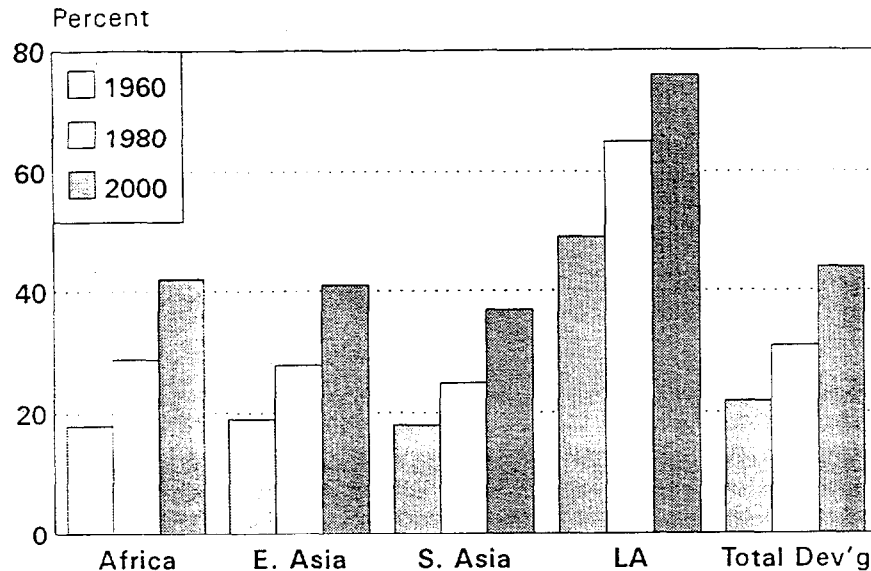


Source: United Nations, 1993.

The high rates of increase in the urban population in the Third World will place severe pressures on the food marketing system including transportation, storage, processing, grading, and market information. In many developing countries, notably those of Sub-Saharan Africa, massive investments in physical infrastructure in both rural and urban areas will be needed to support the feeding of the urban population. Current efforts undertaken as part of economic reforms in many African countries to strengthen efficiency and competition in agricultural marketing through the private sector must be enhanced and the appropriate role of government must be identified.

Urbanization will accelerate the dietary transition associated with increasing incomes. Increasing opportunity cost of women's time; changes in preferences caused by promotion, advertisement, and changing lifestyles; and changes in relative prices associated with rural to urban migration will change food demand from basic staples such as sorghum, millet, maize, and root crops to cereals such as wheat and rice (which require less preparation time), fruits, foods of animal origin, sugar, and processed foods. Rapid increases in the demand for livestock products will have severe repercussions on the demand for cereals as already discussed.

Figure 29—Percent of Population Living in Urban Areas, 1960, 1980, and 2000.



Source: United Nations, 1993.

Rural Infrastructure, Agricultural Production Technology, and Access to Modern Inputs

The importance of investments in rural infrastructure within the context of rapid urbanization was discussed above. However, even in the absence of rapid urban growth, such investments would be needed in many developing countries, particularly the poorest ones, to facilitate agricultural and rural development. Improved rural infrastructure enhances access to export markets, modern production inputs, and consumer goods. It reduces marketing costs, promotes exchange among intra-country markets, reduces spatial and temporal price distortions, and, in general, increases efficiency in production and marketing.

However, while essential, effective rural infrastructure is not sufficient to assure agricultural and rural development and rapid increases in food production in developing countries. Yield-enhancing production technology is of critical importance. Although opportunities for expansion of agricultural production into lands not currently under cultivation still exist in some countries, such opportunities are very limited and would probably not be able to counter losses of current agricultural lands to alternative uses on a global level. Furthermore, attempts to expand agricultural production into new lands would,

in most cases, require very large investments and increase the risk of land degradation. Thus, future increases in food production must come primarily from higher yields per unit of land rather than land expansions.

Agricultural research has successfully developed yield-enhancing technology for the majority of crops grown in temperate zones and for several crops grown in tropical zones. The dramatic impact of agricultural research and modern technology on wheat and rice yields in Asia and Latin America since the mid-1960s is well known and was illustrated earlier. Less dramatic but very significant yield gains have been obtained from research and technological change in other crops, particularly maize. Large yield gains currently being obtained in many crops at the experimental level offer great promise for future yield and production increases at the farm level. In addition to affecting yield levels, research resulting in tolerance or resistance to adverse production factors such as pests and drought and research on new varieties and hybrids better suited for various ecological conditions reduce risks and uncertainty and enhance sustainability in production through better management of natural resources and reduced environmental risks (through reduced use of chemical pesticides and avoidance of irreversible land degradation).

Even if the positive impact on sustainability and natural resource management is ignored, investment in national and international agricultural research has been shown to produce large economic gains relative to costs (Tables 7 and 8). The distribution of economic gains among groups in society varies among countries and over time, depending on a number of issues related to markets, institutions, and policies. Gains captured by producers and agricultural workers contribute to employment, growth, and investment in agriculture and rural areas both directly and indirectly through growth linkages, while gains captured by consumers enhance purchasing power and facilitate employment and economic growth through lower wages and increased demand for goods and services. Depending on the structure of the economy, poverty alleviation in both rural and urban areas would be expected to result.

Accelerated investment in agricultural research and technological improvements is not only necessary and urgent, it is the only viable option to assure sufficient food to meet future needs and demands at reasonable prices without irreversible degradation of our natural resources. While the large past and current economic benefits from agricultural research reflect traditional research methods, the recent development of biotechnological methods is likely to accelerate the research process, i.e. reduce the time needed between initiation of research and expected impact, and greatly enhance the opportunities for improved and higher-yielding plants and animals.

Table 7—Annual rates of return to agricultural research (percent of programs analyzed)

Region	Less Than 10% RR	More Than 50% RR
Africa	20	40
Asia	3	63
Latin America	7	46

Source: Evenson and Rosegrant, 1993.

Table 8—Annual rates of return to agricultural research (percent of programs analyzed)

Commodity	Less Than 10% RR	More Than 50% RR
Wheat	7	43
Rice	0	68
Maize	0	31
Other commodity programs	12	53
Aggregate research programs	1	62

Source: Evenson and Rosegrant, 1993.

The significance of land scarcity was emphasized above. Water is another natural resource becoming increasingly scarce in many production environments. Efforts to meet future food needs and demands while promoting sustainable economic growth and poverty alleviation, including agricultural research and government policy, must pay increasing attention to the efficiency of water use, sustainability of water management practices, and investment in establishing and maintaining irrigation facilities.

Last, but not least, access by farmers to modern inputs such as improved livestock, crop varieties and hybrids, fertilizers, and pest control measures, as well as credit, technical assistance, and improved farm management practices are essential components of a successful strategy to meet food production and development goals. Efforts to enhance farmers' access to modern inputs must recognize the role of women in farming and marketing and design the programs accordingly.

Natural Resource Management and Environmental Considerations

The recent surge in public and private concerns about negative environmental effects of economic growth and development may, if sustained, have important implications for agricultural development and future food production and consumption. Of particular concern is the need to avoid degradation of natural resources such as land and water, as well as deforestation, water contamination, and health risks associated with the use of chemicals. Since most of the current and potential future resource degradation and environmental contamination result from externalities, neither the market nor the individual producers and consumers are likely to incorporate the necessary preventive measures into their behavior. Only when sufficient damage has been done to significantly influence current or future production costs will market and producer behavior change. Preventive measures are likely to come from either publicly funded research and technology development or government policy and regulations. Extensive waterlogging, salination, and associated land degradation and productivity losses resulting from inappropriate water management are of particular concern in large parts of Asia.

In developing countries, poverty, rapid population growth, low agricultural productivity, and poorly defined ownership and user rights to resources are the major risk factors associated with the degradation of natural resources. Attempts to survive or to meet basic needs in the short run take priority over longer-term sustainability. Rural poverty combined with low yield capacity of crops and livestock and poorly defined land ownership lead to unsustainable exploitation of fragile lands, including those with low rainfall. Where land is scarce and population pressures are strong, deforestation is an appealing

solution to poor rural households to mitigate short-run food and income shortfalls. However, the ultimate consequences are likely to be reduced forest land, associated soil erosion, changing rainfall patterns, and general reductions in the productive capacity of the land.

Yield-enhancing agricultural technology is the most promising avenue to sustainable agricultural production. Higher yields on less fragile lands will reduce the pressure on fragile lands and, together with better definition and distribution of land ownership and user rights, will reduce deforestation and desertification. Agricultural research and technology can facilitate production methods on both fragile and less fragile lands that will maintain land quality and productivity over time. Furthermore, appropriate agricultural technology and production practices for drought-prone areas may buffer the negative effects of low and variable rainfall on food security in addition to reversing current trends of land degradation.

Agricultural research has already made great progress on making plants more tolerant or resistant to various pests and on biological pest control, thus reducing the need for chemicals in pest control. The efficiency of chemical pest control methods has been greatly increased, resulting in reduced contamination and personal safety risk. Accelerated research could further reduce the dependence on chemical pest control and thus reduce the risk of contamination of food, water, and air.

As population, poverty, and food demand continue to grow, failure to develop and implement appropriate technology in production and marketing will lead either to more food insecurity and hunger, for which the current generation of poor people will pay, or to further degradation of our natural resources, for which future generations will pay. The trade-off between meeting future food demands and maintaining production capacity can be avoided and sustainability in food production can be assured only if (1) investment in appropriate research and technology is accelerated; (2) relevant externalities, including those related to resource ownership and user rights and the needs of future generations, are either internalized into production and consumption decisions or effectively dealt with by government policy; and (3) poverty is significantly reduced or eradicated.

In view of the large risk of accelerated irreversible degradation of our natural resources and the urgent need to assure sustainable agricultural production to meet future food demands, it is difficult to understand why investment in the most promising solution, agricultural research and technology, appears to be decreasing. While government policy and regulations are essential to assure compatibility between production and environmental goals,

they will have only limited success unless accompanied by appropriate technology.

CONCLUSIONS

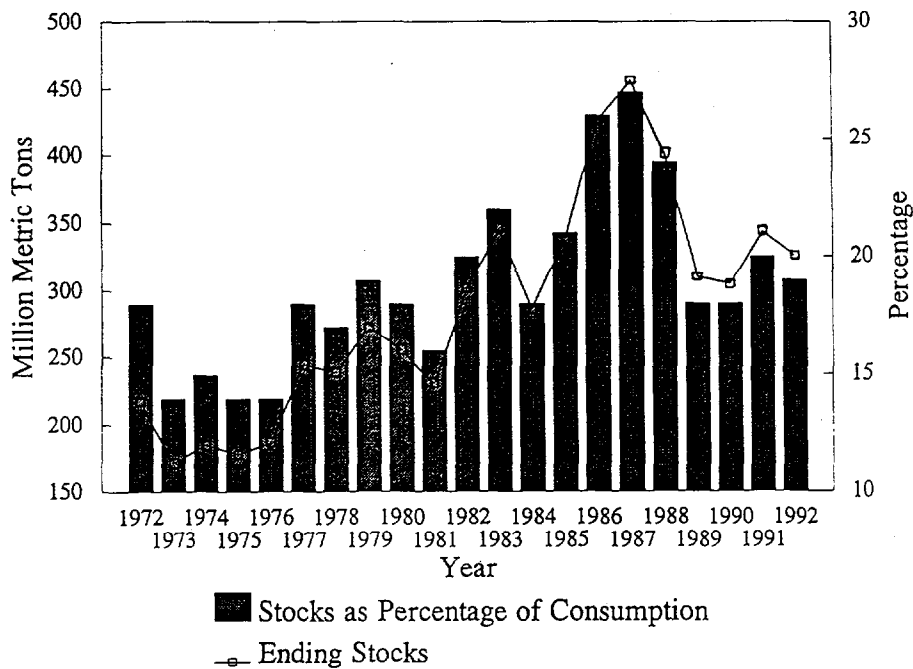
International support to developing-country agriculture including research and technology has been declining since the early 1980s. This trend appears to reflect complacency among OECD countries regarding the food and agriculture situation in developing countries. Is such complacency warranted?

International real food prices continued their long-term decreasing trend during the 1980s and early 1990s, food surpluses continue to be of concern to the European Economic Community and the United States, and there is reason to believe that the former Soviet Union and Eastern Europe will expand food production and possibly reduce food consumption during the next 10 years and perhaps even beyond. Yields of wheat, rice, and maize continue to increase in Asia and parts of Latin America, and a few African countries have shown their ability to rapidly expand food production in response to favorable policies and technologies. World stocks of cereals are at a level of about 300 million tons or 19 percent of annual consumption. Although lower than the mid-1980s, this is considerably higher than the levels immediately prior to the food crisis of the early 1970s (Figure 30). All together reasons for complacency. But unfortunately, such complacency is grossly inappropriate.

Population growth will outstrip growth in food production in Sub-Saharan Africa for a long time to come, unless much more is done to accelerate agricultural growth. Between now and the year 2000, the population will grow at more than 3 percent per year while food production is likely to grow at 2 percent or less per year. By the year 2000, the production shortfall is estimated to increase to about 50 million tons of grain equivalent, up from the current level of about 14 million tons (von Braun and Paulino 1990). It is extremely unlikely that the region will have the necessary foreign exchange to import such large amounts of food. It is equally unlikely that African governments will be able to count on enough food aid to make up the difference. If current trends continue, the World Bank estimates that by the year 2020, Africa will have a food shortage of 250 million tons, which is more than 20 times the current food gap.

Asian food demand is estimated to grow at an annual rate of 2 percent between now and the year 2000, whereas food production is estimated to grow at 1.3 percent per year. Much of the production shortfall is likely to be dealt with through expanded imports and perhaps through expanded regional production in response to price increases.

Figure 30—World stock levels of grains, 1972-1992



Source: FAO, 1992.

In Latin America, by contrast, growth in food production is anticipated to exceed food demand growth: food production is estimated to grow by 3 percent annually between 1990 and the year 2000, while food demand is estimated to grow by 2.5 percent per year.

About 700 million people are food insecure; for them the food crisis has arrived. For the 10 to 12 million preschool children who died last year from hunger and diseases of hunger and malnutrition, the food crisis came and went. One-third of the preschool children of the Third World were unable to grow to the full potential. Growth faltering is associated with high morbidity and mortality risks. While small may be beautiful, the process leading to smallness is not.

The food security prospects for Sub-Saharan Africa are particularly worrisome. Poverty is expected to increase rapidly in the coming years and Sub-Saharan Africa's share of the world's poor is expected to double from the current 16 percent to about 33 percent in the year 2000. Furthermore, the number of underweight children is expected to increase in the 1990s in Sub-Saharan Africa even under the most optimistic assumptions made by the United Nations.

Large extensions of land are degraded and the degradation continues at a rapid rate. High rates of deforestation continue and the principal reasons for environmental degradation: poverty, high population growth, and limited access to appropriate agricultural technology are not being effectively dealt with.

Complacency is not in order. Clearly, Malthus underestimated the power of science to expand food production. The mass starvation that was predicted to occur in Asia in the 1970s and 1980s did not materialize because science was effectively put to work to expand crop yields. However, past yield increases came about because people with foresight made appropriate decisions. Failure to expand investments in agricultural research and technology development during the 1980s and early 1990s indicate that such foresight no longer prevails. Given the long lag time between investment in agricultural research and the resulting production increases, failure to invest today will show up in production shortfalls and environmental degradation 10 to 20 years from now. We must not wait until a global food crisis is upon us or until the last tree has fallen before making these investments. Much of the action needed has been delineated by a number of FAO conferences and publications, by the UNCED conference and Agenda 21, the International Conference on Nutrition, and the World Summit for Children. The upcoming International Population Conference, FAO's 50th Anniversary Conference, and IFPRI's new initiative for a 20-20 Vision on Food, Agriculture, and the Environment will further add building blocks to the development of a common vision for food, agriculture, and the environment, and a consensus for action to bring about such a vision.

Failure to act may prove Malthus right.

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